Russia
Associated Gas Utilization Study

Perrine Toledano, Shay Banerjee, Tom Rollason

Thank you to Tom Mitro for his thorough review

Columbia Center
on Sustainable Investment
A JOINT CENTER OF COLUMBIA LAW SCHOOL
AND THE EARTH INSTITUTE, COLUMBIA UNIVERSITY

Summary of findings

High but gradually declining flare volumes

Unique flare penalty structure

Rising electricity prices

Need for more investment in infrastructure and technology

Strategy to increase reliance on coal

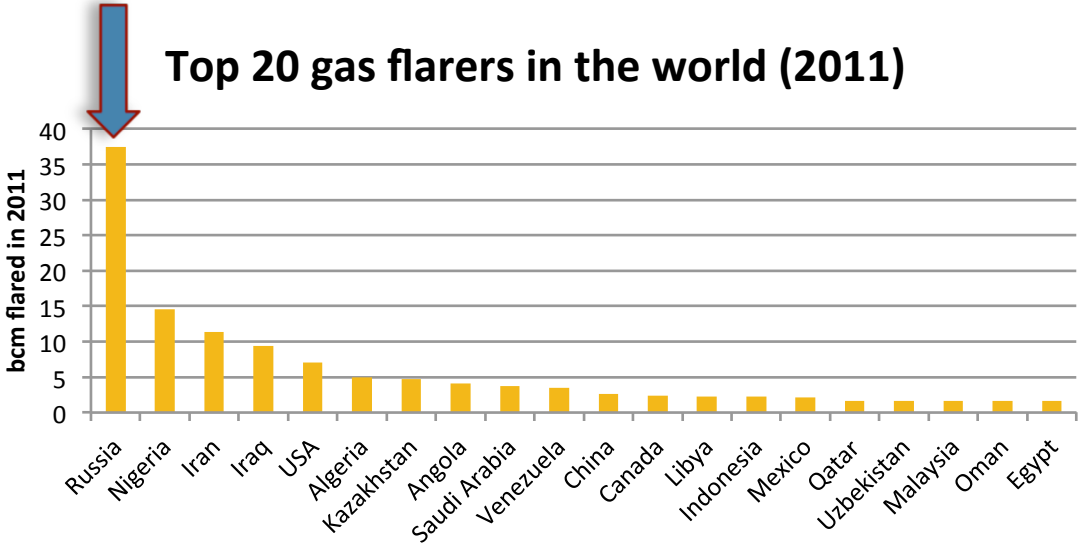
- Russia has the largest levels of Associated Petroleum Gas (APG) flaring in the world whether it is according to national statistics or to the satellite statistics. The latter are however far worse than the former. Companies' misuse of APG cost Russia US$ 13 billion annually, according to Russia's Natural Resources Ministry.
- However, the Russian Federation has taken positive steps toward reducing flaring in the country. Its most significant effort was the 2012 enactment of Decree 1148, which expands on an innovative penalty structure first put in place in 2009.
- The recently enacted regulations, combined with higher electricity prices, have spurred investment in APG utilization infrastructure.
- Unfortunately, the majority of this development appears to be occurring at the biggest fields close to infrastructure, while small-to medium fields, particularly in remote areas, still face challenges in devising an infrastructure solution, which are compounded by the presence of state –owned companies exerting their monopoly power.
- Interestingly, many innovative solutions are being developed to cater to the needs of the small to medium fields in remote areas.
- Nevertheless, Russia's desire to increase coal in the energy mix is counteracting the positive development in APG use.

The statistics of APG flaring in Russia

Statistics on APG flaring

Regional statistics

Companies involved



Source: NOAA satellite data

- Russia is the number one flarer as of 2011, accounting for roughly 26% of the global total.
- During the period from 2006 to 2011, the World Wildlife Fund (WWF) estimated that Russia reduced flaring by roughly 30%. Despite this reduction, Russia's flare volumes in 2011 were still more than double that of Nigeria, the world's second largest burner of APG.
- Incentivized by a strong penalty established in 2009 and strengthened in 2012, the oil industry has been increasing the utilization of APG every year since 2011. Russia included an APG utilization target value of 95% for 2015 into its energy strategy. The target was not reached since the utilization was only about 85% at the start of 2015. The volume of gas flared fell by 22.8% in 2014 and by 14% in 2015. This is a considerable improvement as compared to 2011.

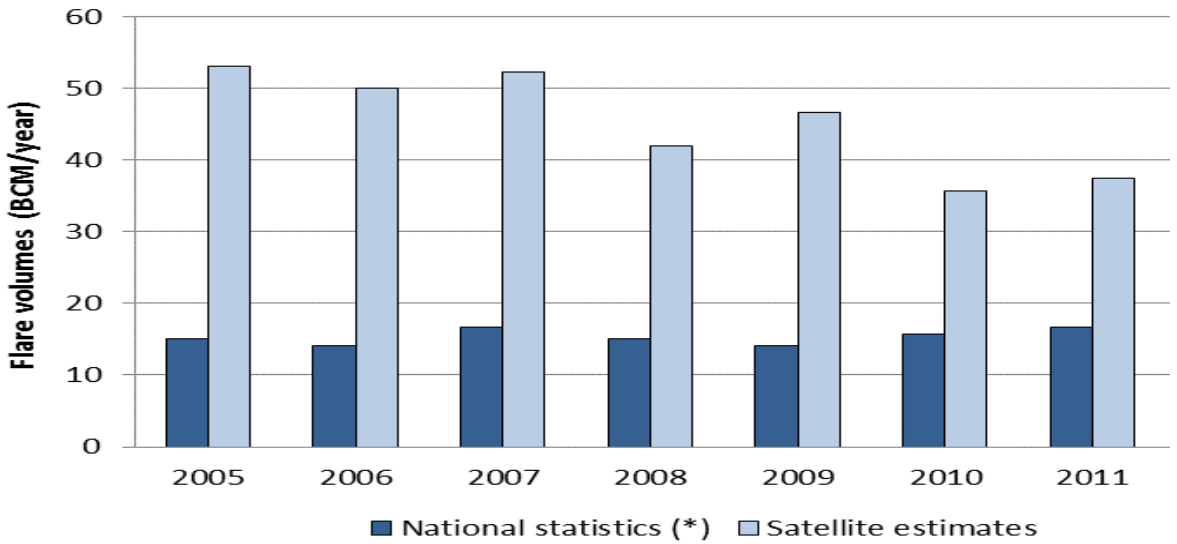
The statistics of APG flaring in Russia

Statistics on APG flaring

Regional statistics

Companies involved

Flare volumes in Russia, national statistics and satellite estimates, bcm/year



(*) Central Dispatch Office of the Russian Fuel and Energy Industry (CDU TEK).
Source: Satellite estimates are from NOAA/GGFR

- Actual volumes are uncertain as official estimates report 15 billion cubic meters (bcm) are burned per year while satellite estimates put the number as high as 50 bcm as of 2011. Official estimates give 10.5 bcm as of 2015.
- This discrepancy in flaring figures is due to metering deficiencies (as of 2014, 84% of facilities in Russia are equipped with measuring devices) with methodologies differing between oil fields and some fields not having metering equipment at all. It is also likely that government and companies are routinely inconsistent and under-report data.

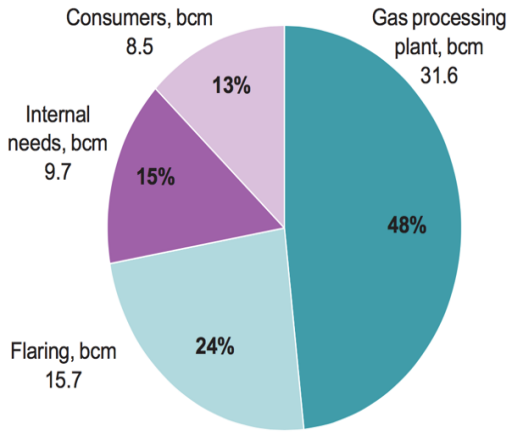
The statistics of APG flaring in Russia

Statistics on APG flaring

Regional statistics

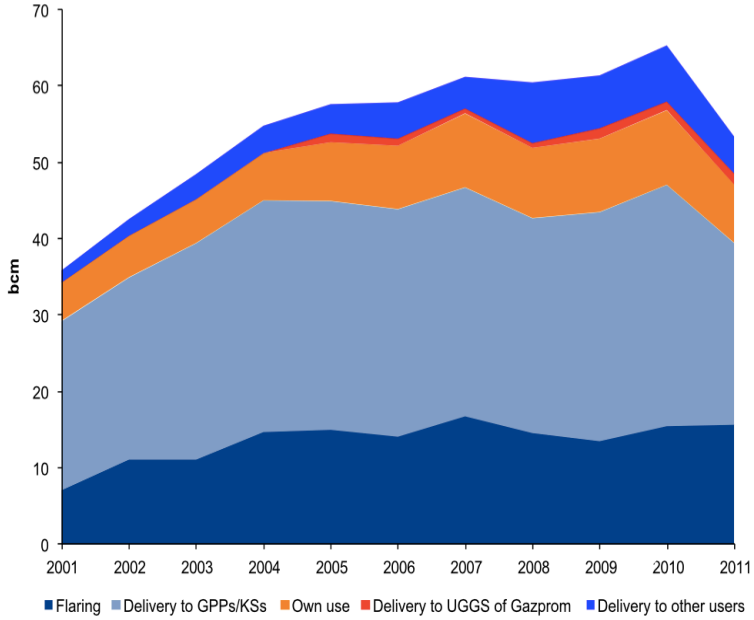
Companies involved

APG use in 2010 (bcm, %)



Source: KPMG, WWF (2012)

APG use and flaring 2001- 2011 (bcm)



Source: Loe, Ladehaug, 2012

- In 2010, gas processing plants (GPPs) used 48% of the APG produced, internal needs (or own use) 15% and consumers 13%.
- In 2014-2015, 49% of produced APG was processed at GPPs, 20% was for own-use and also included losses, 8.5% was supplied to the gas transportation system, and 6.7% was delivered to local consumers. The major change comes thus from the on-site consumption but it is noteworthy that these numbers include losses and wastages.

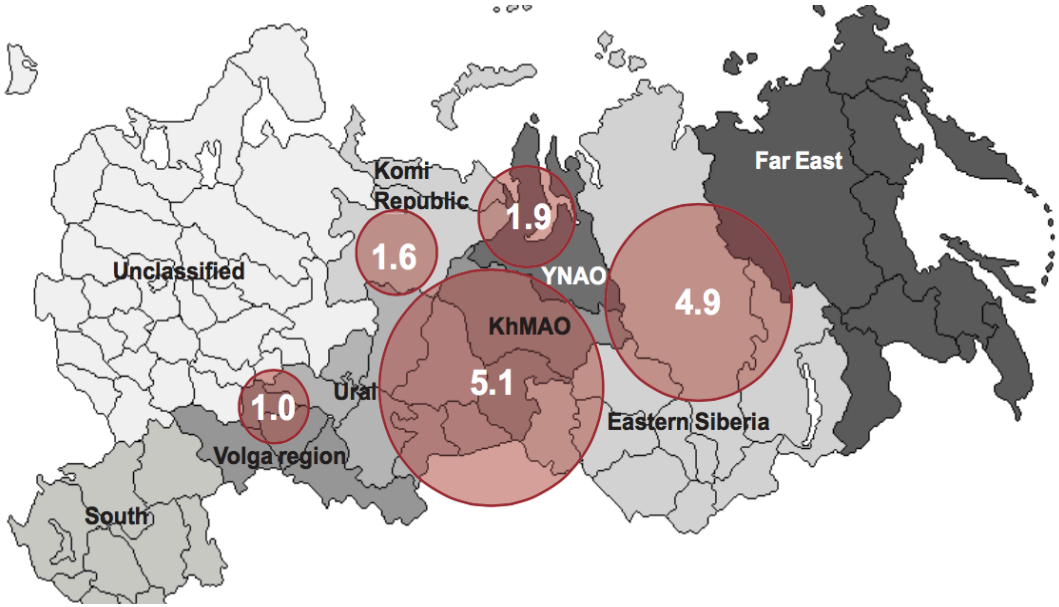
The statistics of APG flaring in Russia

Statistics on APG flaring

Regional statistics

Companies involved

Geographic distribution of main APG flaring volumes (bcm)



Source: KPMG, WWF (2012)

- The majority of the APG flaring occurs in Western Siberia (in Khanty-Mansi Autonomous Okrug (KhMAO) (25%) and Yamalo-Nenets Autonomous Okrug (YNAO) (11%)) and in Eastern Siberia (44%).
- As of 2015, the Siberian Federal District experiences the lowest rate of APG utilization at 58.7%. The districts with the highest APG utilization rate are the Southern Federal District (96.3%) and Ural Federal District (93%).

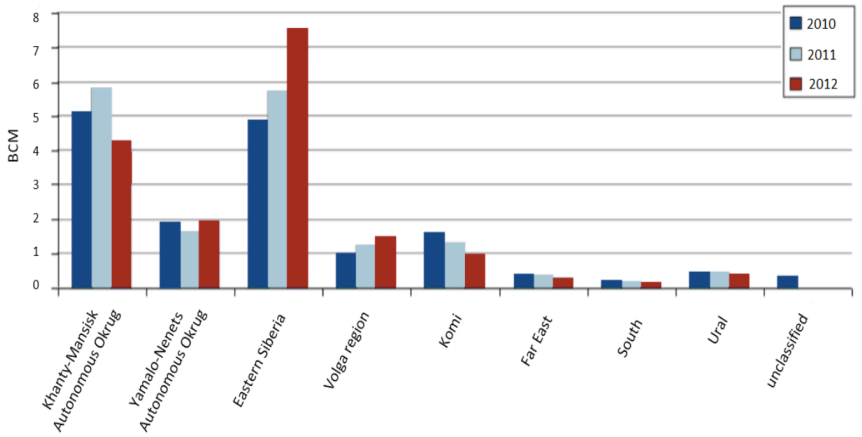
The statistics of APG flaring in Russia

Statistics on APG flaring

Regional statistics

Companies involved

APG flaring by region, 2010- 2012 (bcm)



Source: Carbon Limits, 2013

- In relatively new oil-producing regions, such as Eastern Siberia, gas processing investment is dwarfed by funding for development and production of oil fields and so although they produce less APG than older fields, relatively to the oil production, they end up flaring a higher percentage of the total APG produced in Russia than any other region.

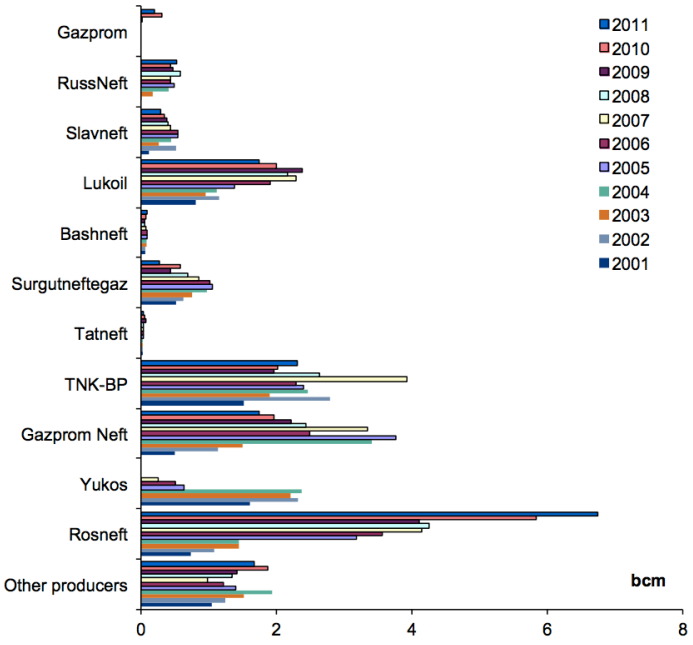
Which companies are involved?

Statistics on APG flaring

Regional statistics

Companies involved

APG faring by company, 2001- 2011 (bcm)



Source: Loe, Ladehaug, 2012

Source: Roseneft

- The five oil companies Surguteneftgaz, TNK-BP, Rosneft, Lukoil, and Gazprom Neft represent 80% of the flared gas in Russia as of 2011. Rosneft, the state-owned oil company has traditionally been the company with the lowest level of APG utilization which it has been improving in the last five years.
- 95% of APG utilization was achieved by five companies in 2013: Gazprom, Salym Petroleum, Sakhalin Energy, Surgutneftegaz and Tatneft with the latter two already reaching this level in 2006. Reportedly, the best utilization rates for APG projects with foreign participation is recorded for Sakhalin-2 and Salym Petroleum. However, data on APG flaring seems absent for Sakhalin-1 (Exxon Neftegaz) and Kharyaga PSA (Total and Statoil).
- Overall, private oil companies have performed better than state-owned companies.

What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

Agencies

Legal framework

Fiscal framework

Government institutions involved in regulation of oil production/flaring	Description
Ministry of Energy	Responsible for drafting and implementing government policy and legal regulation in the oil and fuel sector
Ministry of Natural Resources and Ecology	Administers the licensing regime and coordinates and supervises the agencies responsible for oil and gas regulation
Federal Agency for Subsoil Use	Responsible for regulating exploration and extraction of oil and gas

What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

Agencies

Legal framework

Fiscal framework

- Traditionally, there has been a lack of an effective legislative framework for addressing APG in Russia.
- Partly this has to do with economic factors entwined with oil and gas production dominating the political process over environmental concerns. Coupled with inconsistent enforcement this has led to under-investment in AGP utilization infrastructure.
- In 2009, a working group on APG utilization was established by the Ministry of Energy to improve the legislative and regulatory framework following President Putin's 2007 State of the Union Address announcing that APG utilization would become a national priority.
- In 2010, amendments to the Federal Law "On Electricity" were introduced, which were designed to facilitate priority access for power produced by APG into the Unified National Electricity Grid. The major implementation obstacle is transporting APG produced from oil fields to generators connected to the grid.
- In 2012, an amendment to a 2009 decree sharpens the fines on flaring while providing incentives for infrastructure construction.

What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

Agencies

Legal framework

Fiscal framework

Regulation/Policies on Gas Flaring/AG use	Description
Decree Number 344 June 2003	Establishes a *standard environmental fine* for all air pollutants. For methane, the standard fine is 50 rubles per ton of methane when emissions are within the emission limits established by an air pollution permit and 250 rubles per ton of methane when emissions are outside the limits of the permits.
Decree Number 1148 November 2012 **(Amending Decree Number 7 of January 2009)**	Sets a multiplier for emissions of APG, such that flarers in 2013 were required to pay 12 times the standard environmental fine for APG emissions. For all years after 2013, this "multiplier" is 25 (Art. 2). Furthermore, the multiplier increases to 120 if the operator does not possess adequate monitoring equipment (Art. 5). The applicable multiplier is further increased or reduced based on the region where a field is located. (Art. 5). *Exceptions*: The multiplier is **not** applied, however, for the following: (1) APG emissions that are not greater than the maximum permissible value for APG emissions(Art. 2). Currently this value is equal to 5% of produced APG. For all APG emissions up to this level, the operator pays the standard environmental fine. (2) Certain plots where cumulative production is under 1% of estimated recoverable reserve; and the plots that are either within the 3 years of exceeding the maximum permissible value or within the years during which the cumulative production is under 5% of estimated recoverable reserves; whichever comes earlier (Art. 3). (3) Fields where annual APG volume is below 5 million cubic meters or non-hydrocarbon components represent less than 50% of the gas (Art. 6).

What is the legal and fiscal framework in place to stop flaring and incentivize APG use?

Agencies

Legal framework

Fiscal framework

Regulation/Policies on Gas Flaring/AG use	Description
Decree Number 1148	In addition to setting the multiplier, Decree No. 1148 seeks to resolve the above problem by establishing a fiscal incentive for operators to invest in APG utilization projects. Operators who invest in such projects are allowed to subtract the costs of such investments from the applicable fines (Art. 8). Eligible projects include gas pipelines, compressor stations, separation units, facilities producing electricity/heat, and reinjection equipment. Also included is the cost of equity for investors participating in joint projects with operators who invest in such equipment. The Decree also allows operators of multiple fields to aggregate countrywide APG utilization vis-à-vis flaring for purposes of calculating the 5% minimum permissible target (Arts. 11-15). These provisions help ensure that investment in utilization projects are most efficiently directed to fields where they are most viable. In 2013, the total penalties levied on oil companies amounted to 2.2 billion rubles. In 2015, the heads of five oil companies, such as Lukoil, Gazprom Neft and Surgutneftegas, as well as Bashneft and Tatneft signed a letter for the President asking to lower the multiplying ratio as a means of curbing the Russian crisis.

Infrastructure monopolies

Infrastructure

Power Generation

GTL

Petrochemicals industry

- Instead of building pipelines, operators at remote fields could rely on the extensive network of Gazprom, the Russian gas monopoly.
- Russian law in fact grants non-discriminatory third party access to Gazprom pipelines but only if there is spare capacity and the gas is of requisite quality (the rules of implementation are however too limited to make the law enforceable). Amendments in December 2012 (No. 241-ФЗ) to the 1999 Law on Gas Supply give priority access to spare capacity in gas pipelines to the dry gas produced from APG. Furthermore, Gazprom's refusal to grant access may be appealed in court. Gazprom has however the exclusive right to export natural gas so gas producers willing to export their gas have to sign an agreement with Gazprom. Rosneft is currently asking the government to end this monopoly. Rosneft obtained the right to export LNG.
- In addition, Gazprom doesn't want to diminish its monopoly over the Russian domestic gas market whereas oil companies are allowed to either sell their gas directly to Gazprom or rent space in Gazprom's pipelines. As a result, the price Gazprom offers oil companies for the dry gas is often very low or the rent they charge for space in the pipelines is very high.
- In the remote areas of Western Siberia where oil production is high but gas pipelines too expensive to build given the long distance to market, there has been little excess capacity on Gazprom's pipelines for the dry gas of oil companies and until the recent enforcement of Decree 1148 (see next slide) the companies did not want to enter into cooperative programs to expand the infrastructure, despite Gazprom proposing such programs, precisely because they considered the cost to exceed the gain. Where Gazprom's gas production has been declining, Gazprom has been more flexible to allocate spare capacity on its pipelines.
- In addition, in Western Siberia there are not enough gas processing facilities and five out of the seven existing ones are owned by the company Sibur (state-owned until 2010) which de facto exerts a monopoly (see slide 19). In addition, processing facilities date back to the Soviet Union era. The combination of both factors have acted as a disincentive for the oil companies that seek a commercially viable outlet for their APG.

Infrastructure construction spree

Infrastructure

Power Generation

GTL

Petrochemicals industry

- However, motivated by a desire to achieve the 95% APG utilization rate that would trigger the multiplier exemption specified in Article 2 of Decree 1148, the biggest oil companies have invested in infrastructure starting in 2011. This infrastructure generally equips the biggest fields relatively close to the existing networks.
- Rosneft: The company has been expecting to reach 80% of APG utilization mostly by constructing gas transportation pipelines from Vankorskoye and Malo-Balykskoye fields as well as a number of gas booster compressor stations at its fields in Western Siberia (Komsomolskoye, Kharampurskoye, Priobskoye), Eastern Siberia (Vankorskoye), and Sakhaline (Odoptu-More).
- Gazprom-neft : The major projects of Gazprom neft include the construction of GPP at Yuzhno-Priobsksye compressor station, Yety-Purovskaya and Myldzhinskaya compressor stations as well as the expansion of a gas transportation system in Orenburg region in order to supply APG to Orenburg gas and chemical complex.
- Lukoil: operating primarily in Western Siberia. It constructed 18 compressor stations within 2011-2013, above 700 km of gas pipelines and multiphase pump stations.
- Russneft: In 2014 it launched the ejector station at the oil-processing plant at Nizhne-Shapshinskoye field, commissioned a gas pipeline from the oil-processing plant at Fedyushkinskoye field to the gas turbine power station at Igolsko-Talovoye field, added two additional Jenbacher gas-piston units to increase the nominal installed capacity of Yeguryakhskoye field power complex up to 9.8 MW, and set up a gas boiler at Varioganskoye field. RussNeft has developed a Gas Program for 2015-2017 targeting APG utilization ratio and power efficiency including the construction of gas pipelines and compressors.
- Some of these pipelines connect to Gazprom's network and some other pipelines and GPPs enable these companies to sell directly to the domestic market (gas traders, refineries, end consumers, Sibur – see slide 19) increasing their total market share to 35% with Gazprom having 65% of the domestic market. Gazprom's dominating position on the domestic market diminishes every year.

Other infrastructure solutions for small to medium fields

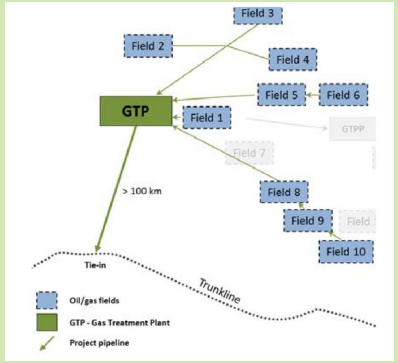
Infrastructure

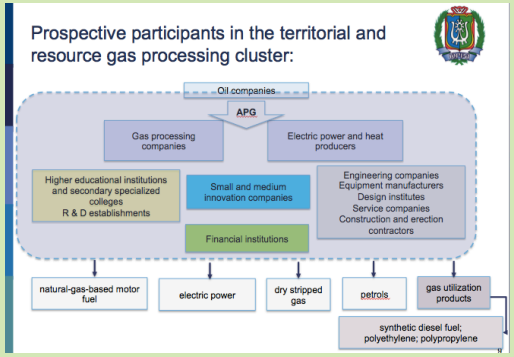
Power Generation

GTL

Petrochemicals industry

- Some initiatives are spearheaded in the KhMAO-Yugra and Samara regions to ensure sustainable APG use in a context of the huge infrastructure needs faced by small to medium fields.
- Since 2012, in the Samara region where the oil deposits are spread over remote distances from the existing gas processing plant, 3 compact GPP projects with a small capacity of 18-80 million cubic meters per year were implemented by oil companies (eg: Tatfnet at the Irgiz field). The gas products are consumed in the region that is one of the top industrial regions of Russia.
- In KhMAO – Yugra region, the non-profit state-supported Yugra Gas Processing Cluster is taking practical steps towards optimizing the APG utilization rate by joining the efforts of oil and gas companies into a collective "APG processing complex (feedstock capacity of 600 million cubic meters per year, pipeline for dry topped gas supply to Gazprom's transport system), LNG plant for autonomous gas supply (capacity up to 25 tons per hour) and APG to natural gas conversion unit (capacity up to 1 thousand cubic meters per hour)" (CreonEnergy, 2015). The goal is to cluster oil companies, gas processing, power utilities, higher education institutions, engineering firms and financials institutions together to foster innovation around APG use while saving costs through economies of scale.





Source: Presentation by the Government of KhMAO-Yugra, 2013

Power Generation – Close to the grid

Infrastructure

Power Generation

GTL

Petrochemicals industry

- In traditional oil-producing regions of Russia, power needs are typically met with electricity from the grid.
- However, as the Russian power sector has slowly liberalized, electricity prices have increased (by up to 20% annually in some areas), making APG power plants a more viable alternative. These plants either partially or fully offset the costs of grid obtained electricity in areas with old or constrained electricity distribution systems.
- For example, in 2013 a 315-MW captive gas turbine power plant (the largest of its kind in Russia) was commissioned at the Priobskoye field (owned by Rosneft and Gazprom- neft in Western Siberia) for on-site consumption. Previously, the field had been supplied by electricity from the grid.
- Similarly, in 2008, TNK-BP (now owned by Rosneft) set up a joint venture with the power generation company Oskarshamns verkets Kraftgrupp AB to construct new power plants in Nizhnevartovsk. The joint venture reached a capacity of 1600 MW. The objective was to ensure uninterrupted supply of electricity to the company's operations when electricity tariffs are increasing and an outlet for the APG that is in excess of the company's needs.
- It is however noteworthy that Russia's strategy to diminish its reliance on gas and increase the share of coal in the fuel consumption structure is working against the objective of reducing flaring.

Power Generation – Remote from the grid

Infrastructure

Power Generation

GTL

Petrochemicals industry

Source: Encyclopedia of Safety

- For oil fields far from the grid, local power generation may be the best way to utilize APG. Fields in areas such as Timan-Pechora, the western parts of KhMAO, Tyumen and Eastern Siberia cannot be powered with electricity from the centralized power grid.
- Typically, the solution was to use localized diesel-powered plants. Recently, a large number of oil fields have installed small-scale gas turbine power plants to increase APG utilization, saving on the investment in diesel-fired power plants and on the fuel to run them.

Gas to Liquids – Small remote fields

Infrastructure

Power Generation

GTL

Petrochemicals industry

- The major oil companies in Russia are considering resorting to to modular Gas to Liquids (GTL) technology for their APG. This technology is particularly relevant for small – to medium fields in remote areas where pipelines and gas processing are difficult to access.
- In 2014, Rosneft, in partnership with the Russian firm Gazohim Techno, built a gas-to-liquids demonstration plant at Rosneft's Angarsk Petrochemical Complex in Irkutsk Oblast (South-East Siberia).
- The plant utilizes the APG from several remote small- and medium-sized fields and has a throughput capacity of 10 million cubic meters of gas per year.
- It produces approximately 100 barrels per day of synthetic crude.
- In 2015, Gazohim Techno also started the construction of a pilot mini GTL plant for processing up to 12 million cubic meters of APG per year at the field in Komi Republic.
- Gazohim's mini-GTL technology is a combination of a proprietary partial oxidation process with the Fischer-Tropsch technology. It is expected to result in smaller environmental footprint and lower capital and operating costs.

Petrochemicals

Infrastructure

Power Generation

GTL

Petrochemicals industry

- SIBUR, a previously state-owned company, is an integrated gas processing and petrochemical company. SIBUR owns and operates Russia's largest GPPs in terms of APG volumes, mostly located in Western Siberia and is a leader in the Russian petrochemicals industry. Sibur's infrastructure includes seven out of the nine existing gas GPPs in Western Siberia, five compressor stations, and three gas fractionation units (GFUs). As of 31 December 2014, SIBUR had APG processing capacity of 23.1 bcm per annum and raw NGL fractionation capacity of 8.8 million tons per annum.

- SIBUR has 2 business segments: 1) feedstock and energy segment which comprises (i) gathering and processing of APG purchased from Russian oil companies of Western Siberia, (ii) transportation, fractionation and other processing of NGL either produced internally or purchased from oil and gas companies, and (iii) marketing and sales of energy products on the Russian and international markets

- Sibur uses some of the energy product as feedstock for its second petrochemicals segment, which processes them into various petrochemicals, including basic polymers, synthetic rubbers, plastics and products of organic synthesis, as well as intermediates and other chemicals. Sibur operates "three steam cracker facilities, one PDH unit, two basic polymers production plants, manufacturing low density polyethylene (LDPE) and polypropylene (PP), three synthetic rubbers production plants, manufacturing commodity and specialty rubbers as well as thermoplastic elastomers, and 13 production plants manufacturing plastics and organic synthesis products, including polyethylene terephthalate, glycols, alcohols, BOPP-films, expandable polystyrene, acrylates as well as a wide range of intermediate chemicals" (Special Chem, 2015). As of 31 December 2014, Sibur's "basic polymers production capacity was 995,000 tonnes per annum, synthetic rubbers production capacity was 573,000 tonnes per annum and plastics and products of organic synthesis production capacity was 1,008,800 tonnes per annum" (Special Chem, 2015).

References

- CreonEnergy, "APG 2015 event report," (March 23, 2015)
- Kilzie, F. N., "How to Reduce the APG Flaring in Russia?," EconoMonitor (September 11, 2015)
- Farina, M.F., "Flare Gas Reduction: Recent global trends and policy considerations," GE Energy, Global Strategy and Planning (Nov 9, 2011)
- Government of Kanthy-Mansiysk Autonomous Okrug – Yugra, "Creation of a pilot cluster for the effective APG and the low-pressure gas usage in the Khanty-Mansiysk Autonomous Okrug – Yugra," Presentation, Vienna (2013)
- Haugland, T., "Associated Petroleum Gas Flaring Study for Russia, Kazakhstan, Turkmenistan, and Azerbaijan," Carbon Limits Final Report (Nov 2013)
- Josefson J. and Rotar A., "Oil and Gas Regulation in the Russian Federation: Overview," Practical Law (June 2014)
- KPMG, WWF, "Associated Gas Utilization in Russia: Issues and Prospects, Annual Report," Issue 4, (2012)
- Levit, D., "Gazprom Retaliates Against Competitors' Attempts on its Natural Gas Export Monopoly," Economic Calendar.com (April 12, 2016)
- Lisin E., Rogalev A., Strielkowski W, Komarov I., "Sustainable Modernization of the Russian Power Utilities Industry," *Sustainability Journal*, ISSN 2071-1050 (2015)
- Loe J. S.P and Ladehaug O., "Reducing gas flaring in Russia: Gloomy outlook in times of economic insecurity," Energy Policy 50 pp 507–517 (2012)
- Order of the Russian Federation N 344, "About Standards of the Payment for Emissions," (June 2003)

References

- Order of the Russian Federation N 1148, "About Features of Calculation of the Payment For Emissions," (Nov 2012)
- PFC Energy, "Using Russia's Associated Gas, Report prepared for the Global Gas Flaring Reduction Partnership and the World Bank," (December 2007)
- Roland, T. H., "Associated Petroleum Gas in Russia: Reasons for non-utilization," Fridtjof Nansen Institute (2010)
- Rosneft, 2015 Annual Report
- Rosneft, "Associated Gas Recovery Project for Komsomolskoye Oil Field," Monitoring Report (May 2012).
- Rosneft, "Rosneft Increases APG Utilization to 95% at Sakhalinmorneftegaz," (July 2011).
- Russneft, "APG Utilization and Payments," (March 3, 2015)
- Russneft, "Gas Projects," (2015)
- Special Chem, "Sibur Manufactures Six New LDPE Grades For Packaging Industry," (May 29, 2015)
- The Oxford Institute for Energy Studies, "Evolution of gas pipeline regulation in Russia: Third party access, capacity allocation and transportation tariffs," (March 2015)
- The World Bank, "Gas Flaring Reductions Avoid 30 Million Tons of Carbon Dioxide Emissions in 2010," (2011)